National Aeronautics and Space Administration

AEROSPACE TECHNOLOGY ADVISORY COMMITTEE

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NASA Headquarters
Washington, DC

MEETING REPORT

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David O. Swain, Chair Date

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Meeting Summary

Morning Session, March 24

Opening Remarks

Michael Green, Executive Director of the Aerospace Technology Advisory Committee (ATAC), opened the meeting by welcoming participants and introducing Victor Lebacqz as the newly confirmed Associate Administrator for the Office of Aeronautics. Mr. Green then announced several additions to the ATAC membership: Randal Null (NASA's Assistant Administrator for Aviation Operations), Mary Ellen Weber (Associate Vice President at Southwestern Medical Center at the University of Texas), Jeffrey Wieringa (Assistant Commander for Research and Engineering, Naval Air Systems Command), and Joan Bauerlein (Director of the Office of Research and Development at the Federal Aviation Administration [FAA). Adm. Wieringa replaced Adm. Heely and John Olcott's term ended. It was also mentioned that the FAA had detailed Herman Rediess to the new Joint Planning and Development Office (JPDO). (Later in the session, Dr. Lebacqz recognized Jean Bianco as the new Executive Officer for Code R.)

Mr. Green next outlined the sequence of advisory meetings in Code R over the past year. He suggested that the next ATAC meeting would occur next September in a joint session with the Research, Engineering and Development Advisory Committee (REDAC) of the FAA. At the end of his remarks, Mr. Green alluded to a proposed new enterprise charter that was being circulated among the agency's senior managers.

ATAC Chairman David Swain also offered some introductory comments, noting how Code R was being redefined in light the President's new space program directive and the subsequent reorganization within NASA. In addition, he reported on two meetings of the NASA Advisory Council (NAC). In one session he had briefed participants on air traffic management (ATM) and workforce issues; the other meeting was largely devoted to the new space initiative.

Agency Reorganization/Associate Administrator Overview

After welcoming meeting participants, Dr. Lebacqz sketched out some of the recent structural changes within NASA, whose constituent enterprises had increased from six to seven. The latest—Exploration Systems—had come into being following the President's January directive on space policy. Although space exploration would serve as NASA's central focus in the years ahead, Dr. Lebacqz emphasized that the agency's overall mission had not changed: understanding and protecting the home planet were still considered vital parts of NASA's charter and the Aeronautics enterprise.

Next Dr. Lebacqz summarized the basic components of the Space Exploration Initiative. These included sustained and affordable solar system exploration; robotic return to the moon by 2008 and human return by 2020; development of innovative technologies and infrastructure for exploration and decision-making; and promotion of international and commercial participation. (He pointed out that the dates cited did not represent "hard"

targets.) To accomplish these goals, it would be necessary to restore the Space Shuttle to flight, complete the International Space Station (ISS), restrict ISS research to long-duration space flight issues, and develop a Crewed Exploration Vehicle (CEV). Research and development that had started out in Code R within the Orbital Space Plane (OSP) and Next Generation Launch Technology (NGLT) programs would contribute to these efforts, but only from within the new exploration enterprise in which they would now be housed. Given the shift of space-related activities out of Code R, its name would change from "Aerospace" to "Aeronautics."

Both Dr. Lebacqz and Mr. Swain stressed the distinctive nature of the Presidential directive. It had been not simply a speech, but also a policy statement on the Nation's space program, delivered during the second visit of a President to NASA Headquarters.

In Aeronautics, the directive resulted in the departure of three program themes: the Space Launch Initiative, Mission and Science Measurement (MSM) Technology, and Innovative Technology Transfer Partnerships. Despite the migration of these activities to the new enterprise, the budget for aeronautics had essentially remained untouched. Mr. Swain suggested that isolating aeronautics in this way would in fact promote greater transparency of agency investments in this area. Dr. Lebacqz also found much to affirm in the reorganization, although he did register particular concern about the loss of MSM activities. This cross-cutting theme remained fundamental to Aeronautics because of the importance of next-generation high-end computing to the field.

Continuing his presentation, Dr. Lebacqz elaborated on the mission of Aeronautics, such as pioneering and validating high-payoff technologies, improving the quality of life, and enabling scientific discovery. He noted that programmatic success was at one time also defined "as used by others." He had intentionally removed this qualifier because of its potential to unduly circumscribe risk taking. Certain activities might well serve NASA's long-term exploratory goals even though such activities posed considerable risks and promised few or no applications outside the agency. Sometimes NASA needed to demonstrate a leap forward to capture the imagination of the public and the next generation of explorers. Mr. Swain and Robert Spitzer, however, emphasized the importance of the technologies developed, which indeed might have application in industry even if the agency's experimental vehicles did not.

The discussion turned to the area of hypersonics, which no longer had a secure home in the agency. Within the new Exploration enterprise, air-breathing engines were not under active consideration for first-stage uses, and within the reorganized Code R it was difficult to justify taking money out of its three base programs for extended hypersonics research. Dr. Lebacqz indicated that his office was engaged in discussions with NAI about a potential partnership in this area. In addition, a multi-center team was exploring the possibilities for further fundamental hypersonics research.

After Dr. Lebacqz resumed his presentation, the focus shifted to Congressional earmarks. He noted that the difference in budget figures between FY04 and FY05 could be attributed in part to earmarks that were not be being projected into the new fiscal year.

(The other reason for the disparity between yearly budgets was the termination of the Advanced Air Transportation Technology [AATT] project in FY04 and the FY05 follow-on activity at a lower funding level). There was widespread sentiment across the agency against site-specific earmarks. They created discontinuities in long-term planning and drew money away from other programs because of the reporting requirements for full-cost accounting. The agency as a whole was not initiating any work on $388 million in current earmarks before they had undergone the same level of scrutiny required for grant applications—i.e., evaluated for value to agency, cost credibility, and cutting-edge science/technology. NASA was, however, establishing a different set of decision gates for general earmarks because they gave the agency more flexibility for resource deployment.

In the ensuing discussion, Linda Katehi pointed out that many universities did not like earmarks, despite pressure from State representatives to accept them, especially when the institution did not have the infrastructure to support the new work. Most of the targeted funding went to State universities, Aaron Gellman added. Mr. Spitzer recommended the codification and regular dissemination of principles that outlined NASA's opposition to earmarks. Ed Crow also recommended codification, but expressed skepticism that a single agency could change the will of Congress. Similarly, Frank Cappuccio doubted whether anyone could stop earmarks, but he suggested that NASA could stay one step ahead of them by helping Congress shape them once it became clear they were in the pipeline. In Ron Swanda's view, however, there was also a positive side to earmarks, in that they allowed the rest of the country outside NASA to express differences with agency decision-makers and to establish new priorities. Dr. Lebacqz replied that site-specific legislation was not the appropriate channel for setting policy. Toward the end of this discussion, Mr. Swain proposed that ATAC come to a conclusion about this issue.

Although Code R had retained its budget level for aeronautics programs, it had not increased its funding, as recommended by the President's Commission on the Future of the Aerospace Industry and other studies, observed Mr. Swanda. He and Dr. Lebacqz agreed that the best solution was not to ask for a higher fixed percentage of the overall agency budget, but rather to demonstrate programs with exciting potential and to highlight the benefits of accelerated schedules made possible by additional funding. Mr. Swain noted that it was important for those communicating with Congress to emphasize to that body that budget numbers reflected full-cost accounting.

Resuming his presentation, Dr. Lebacqz cited the recommendations emerging from four groups on the future of aviation: the President's Commission (noted above), American Society for Mechanical Engineers, National Research Council (NRC), and Aerospace Industries Association (AIA). Other sources of input for shaping the enterprise's priorities included the new Industry Technology Leadership Team and a planned Council of Deans that could serve as a subcommittee to ATAC. Dr. Lebacqz said that relationships with academia in particular needed to be repaired because of funding discontinuities in previous decades. Mark Anderson, however, asserted that NASA already enjoyed robust engagement with both universities and the academic community.

Dr. Crow raised a question about whether NASA should be considered the developer and keeper of the Nation's aeronautics vision. Dr. Lebacqz agreed that this subject deserved extensive discussion. Dr. Gellman cited Europe's 2020 Vision in this context. In Mr. Anderson's view, it was difficult to think of a better organization than NASA for this task. Thomas Brackey observed, however, that the agency's role in this regard lacked crispness. Perhaps this was because Code R served both the agency and aviation as a whole, Dr. Lebacqz replied. Mary Ellen Weber suggested that it was important for agency leadership to express its vision. Dr. Lebacqz acknowledged that he tended to be customer driven, although he also intended to pursue certain cutting-edge concepts whether or not the world of commerce took an active interest.

At this point, Dr. Lebacqz returned to a request made in a previous advisory meeting—i.e., a presentation of his top five priorities as the new Associate Administrator. His first was to help ensure the transformation of the National Airspace System (NAS) through the Joint Planning and Development Office (JPDO). The remaining priorities focused on improvements and acceleration of aviation safety and security (including environmental impacts), uncrewed air vehicles (UAVs), supersonics, and planetary aircraft.

Most of the ensuing discussion centered on the JPDO, particularly its potential to serve as a bridge to FAA implementation. Terry Hertz suggested that it was more useful to think of the JPDO as the foundation to the bridge rather than the bridge itself. Dr. Gellman observed that the bridge was not well defined and that NASA should not wait until others worked on the issues. Mr. Hertz noted that the lack of definition stemmed in part from the major reorganization now taking place at the FAA.

Dr. Lebacqz reported that the initial focus of the JPDO would center on ATM, although some wanted a broader scope at this stage. ATM represented a logical starting point, he said, because it was important to get the JPDO up and running and to achieve some success in an area where a lot of development had already taken place. Herman Rediess indicated that the FAA did intend to address the entire spectrum of aviation issues through the JPDO, but that this did not mean that all the different technologies were at the same level of development. With ATM, the agencies had a head start.

The next part of Dr. Lebacqz's presentation featured video clips of groundbreaking activities in aeronautics, including an engineered sonic boom reduction, simulation of an X-43A test flight (scheduled to occur soon), flight of the solar-powered Helios aircraft (attained altitude of 96,000 feet), and an animation of a Mars aircraft flying 2 km over the planet's surface. Although several of these projects had experienced failure, Dr. Lebacqz concluded that risk-taking was simply a part of the learning process and that insight had been gained even when aircraft had been destroyed. He acknowledged being disappointed that a Code R proposal to develop a Mars aircraft had lost out to a rover in a Space Science mission competition. He was nevertheless determined to reduce project risk to the point that a Code R award could be achieved in the future. In concluding his presentation, Dr. Lebacqz noted that Michael Reischman would depart for the National Science Foundation in 3 weeks and that Code R would be interviewing candidates from

the academic community to replace him through an IPA position. Dr. Lebacqz also emphasized that he wanted to increase external review to help select the Nation's best to do the work of the enterprise. It was important to convince the Office of Management and Budget (OMB) that Code R had achieved the proper balance of in- and out-of-house talent. He asked the ATAC membership to investigate the best way to attain this balance, although he was not seeking recommendations for arbitrary percentages. The new Council of Deans could also help with this task.

JPDO Update

As NASA's onsite representative in the JPDO office, Robert Pearce began his report by summarizing the background of this multi-agency organization. It formed as a result of FAA reauthorization language calling for transformation of the NAS; recommendations in several pivotal reports on aviation also played a key role in JPDO's formation. Mr. Pearce emphasized the need for *transformation*, not merely evolution of the system into something else. Revolutionary change needed to occur in synchronized fashion across many areas, including not only ATM but also environmental impacts and safety/security. Objectives included the development of a National Plan, partnerships with industry, harmonization of international regulation, policy and program alignment among national agencies, and application of metrics to measure progress.

JPDO comprised two levels. The first was a Senior Interagency Policy Committee made up of agency heads from NASA, FAA, Department of Commerce, Department of Homeland Security (DHS), and the Air Force, as well as the President's Science Advisor. This group would address major issues at the regulatory and legislative levels. There was also a small JPDO office staffed by a dozen individuals. In addition, participating agencies had designated a principal conduit for communication; in NASA Mr. Hertz assumed this role.

Mr. Pearce outlined efforts to formulate a National Plan, including a transition roadmap and action steps. The Policy Committee had already endorsed a draft plan, including a set of national goals. It was expected that volume 1 would be released by June 2004 and that volume 2 would be issued in the early fall.

As had been noted earlier, the JPDO would initially focus on operational ATM concepts, pushing the boundaries established by the RTCA and delving more substantively into policy and technical issues. Staff were looking at control and planning authorities, from ground controls in today's NAS to self-separating autonomous systems. There was a need to assess costs and benefits and then drive down to metrics that could determine how well concepts could perform. Mr. Pearce displayed a planning model illustrating a three-fold approach: to develop goals and objectives; to decompose these into components; and to evaluate strategic barriers and opportunities. The FAA had developed a top-level NAS simulator to evaluate various alternatives through the goal decomposition process. Conversely, there was a synthesis loop to consolidate the values of engaged agencies; from this synthesis would emerge an action plan. A series of meetings with industry would allow additional input into both the analysis and synthesis activities under way. Within a week a futures workshop would convene to synthesize concepts. From mid-

April to mid-May, there would be focus teams adding industry ideas to existing studies and refining analyses. Then in early June would follow a stakeholders evaluation workshop to generate feedback on the analysis. The REDAC would provide an independent review of the entire process. More information on the subject can be found at http://www.jpo.aero.

At the conclusion of Mr. Pearce's presentation, several questions and comments surfaced, especially in regard to the relationship of the JPDO's activities to NASA's. Mr. Pearce replied that basic research and exploratory activities did not form the core of the JPDO mission; that was more NASA's role. There was some overlap in applied ATM areas, however. Much less overlap existed in vehicle systems at the moment. Dr. Rediess pointed to an ongoing effort across agencies to pull together R&D work in these areas to establish a baseline. William Hoover questioned whether the emphasis on developing a plan was overshadowing the need for a workable decision-making process. Mr. Pearce acknowledged that the process would not approach perfection in the early stages and that continuing dialog would be necessary. Dr. Gellman suggested that it was important for NASA to induce agencies to use performance specifications for subsystem hardware and software rather than rely on traditional design specifications. He also said that more input from small business would promote innovation.

The discussion shifted to budgetary considerations within the JPDO. Mr. Cappuccio asked about any plans to fund sought-after products. Mr. Pearce noted that the authorization language for the JPDO provided $50 million, although appropriation would have to occur before the money could be used. The FAA and Code R also had small amounts that they might contribute. In the long term, however, agencies needed to develop a permanent funding arrangement. Dr. Rediess said that the FAA was considering a $3 million dollar request for the current fiscal year and a $5 million request for FY05. The Department of Defense would be more likely to contribute leveraged technology than direct funding. The Transportation Security Administration (TSA) had a budget for security R&D that could be tapped.

Subcommittee discussion concluded with a question from Mr. Swanda about whether JPDO activities should replace meetings at the highest levels of the FAA and NASA, as provided for in bilateral memoranda of agreement (MOA). Mr. Pearce indicated that he did not wish to abolish the MOAs but that it would be useful to move forward through broader multi-agency engagements. Dr. Rediess reported that it had been decided to let the existing mechanisms of engagement continue in the short term; as the JPDO matured, however, this policy could be reevaluated.

Afternoon Session

Aeronautics Update

Mr. Hertz began with a review of budgetary changes within Code R. It had been necessary to make $126 million in adjustments to program funding to resolve shortfalls. Thus the enterprise had added $25 million in FY04 to the X-43A to prepare for flight

testing; $11 million between FY05 and FY06 for the Small Aircraft Transportation System (SATS); and $15 million this year for rotorcraft. He said that NASA had received a favorable OMB response to a draft Program Assessment Rating Tool (PART) submission and were already working on areas critiqued in the review.

The presentation provided itemized budgets and program descriptions for three Aeronautics programs: Aviation Safety and Security, Vehicle Systems, and Airspace Systems. In FY05, the safety program was on target to come to a successful conclusion of phase 1; in FY06, phase 2 would refine the program and develop problem prevention strategies. Vehicle Systems, now through a major reformulation, was planning a large workshop in Atlanta in mid-May, followed by an internal program management review. In Airspace Systems, the AATT program was ending and the Next National Airspace System (NextNAS) was still in the preliminary stages. For each program, Mr. Hertz indicated general and site-specific earmarks, with the largest share going to supersonic and military vehicles, aviation security, and ATM systems and modeling.

Mr. Hertz reported that Code R was developing metrics to gauge progress toward its blueprint objectives. In aviation safety, for example, the enterprise sought a 50-percent reduction in the fatal accident rate relative to the 1991-96 average. Other targets were shown for up to 8 years into the future. Speaking to the realism of reaching these objectives, Mr. Hertz declared that all NASA could do was to *enable* the fulfillment of objectives by developing the necessary technology and supporting analyses; actual implementation would fall to others, such as the JPDO. Dr Crow emphasized that Code R had identified and worked with the logical customers for its technologies. Mr. Hertz noted that even when a potential NASA customer opted for a competitor's product, technology transfer could still take place.

Dev Banerjee asked whether the budget shown reflected Code R's programmatic priorities. Mr. Hertz replied that it did, given the available resources. He said that Dr. Lebacqz's different priorities were financially supported at varying levels and that if more funding became available, it would flow toward them. Meanwhile he was proceeding under the assumption that Code R would be receiving the same level of funding over the long term. This allowed him to determine and report what resources would be needed to accomplish an objective within a certain timeframe. Thus, if stakeholders were unhappy with a protracted schedule to transform the NAS, they could seek more funding to accelerate it.

Mr. Swanda questioned whether the main safety goal applied to general aviation (GA) and whether the interim targets were being met. Mr. Hertz replied that the fatality rate target reflected a composite figure. When decomposed for GA, the target became a 25-percent reduction. He also acknowledged that all the numeric goals were still on the table for scrutiny.

Mr. Spitzer asked whether Code R believed that it was receiving an adequate range of input from the various stakeholders within aviation—manufacturers, airlines, GA, second-tier suppliers, etc. Mr. Hertz questioned whether a 15-person advisory committee

could properly serve this function. Holding large workshops in accessible metropolitan areas—something accomplished with great success in the Vehicle Systems program—might, however. Today's NASA operated with far broader bandwidth and fidelity of information than took place just a few years ago, Dr. Crow observed. Mr. Spitzer suggested that NASA tout its revitalized outreach more often.

NASA's mobility targets concerned Adm. Wieringa, who noted that the coming increase in customer demands was not likely to be linear. Mr. Hertz agreed, saying that the 3X increase projected for the next two decades had yet to be fully defined. To be aligned with the National Plan, operations would need to leap from 1X to 3X rather than to 2X.

Continuing his presentation, Mr. Hertz elaborated on the goals, objectives, and strategic technical focus areas of various enterprise programs. In Airspace Systems, for example, the principal goals were to increase capacity and mobility. The objectives flowing from these included the development of technology to improve throughput, flexibility, and predictability—not only for commercial aviation, but also for GA and runway-independent aircraft. Focus areas covered efficient traffic flow, system-wide operations within the NAS and global network, and human factors. When analyses were completed, it would be possible to not only look at the new ATM technologies themselves, but also their impact on safety and security.

The discussion shifted to the linkage between safety and security, at the prompting of Mr. Swanda. Mr. Hertz assured him that Code R did not intend to combine these key areas. Although there was a single program manager overseeing both, there was a deputy for safety and a deputy for security. The enterprise budget also made a clear distinction between expenditures for each, as well as between their deliverables. Having said this, Mr. Hertz acknowledged certain overlapping issues. For example, safety technologies could sometimes be applied to security, and identical conditions could arise—e.g., loss of an aircraft control surface—from either an accidental or intentional source.

Turning to Vehicle Systems, Mr. Hertz described the work of the enterprise in developing quieter aircraft with better performance; autonomous control systems were also being refined. He noted that the baseline roadmap of this program was the most fully articulated of all in Code R. In FY05, the enterprise was planning to demonstrate a 70-percent NOx emission reduction, complete a lab assessment of a slotted-wing concept, and demonstrate integrated technologies and policies for high-altitude, long-endurance (HALE) UAVs. Staff were developing roadmaps for six "vision" or notional vehicles (sub- and supersonic, personal, etc.). Technology developers would then step up to the theme level roadmaps to evaluate how air safety/security and ATM systems applied to the new vehicles. Something similar was expected to happen as the JPDO focused its initial energies on the airspace system.

The dialog touched briefly on the X-43A. Mr. Hertz described how experimenters had lost a test model in 2001 because of a control failure at a lower-than-optimal launch altitude. Another flight scheduled for September 2003 had been postponed to the spring of 2004. He emphasized that the failure had in fact revealed a great deal about the

aerodynamics of the aircraft, and in that sense not all had been lost. Mr. Cappuccio agreed that such were the risks and benefits of pushing the envelope. Mr. Swain observed that the mishap had demonstrated the need to have an experienced contractor with roles clearly defined for all parties, including NASA. It was important for senior-level people to ask hard questions during the planning stages, he added.

The remainder of Mr. Hertz's presentation highlighted the 12 top recommendations of the NRC's recently released review of Code R (see Appendices to this ATAC summary). This report addressed four questions posed by the agency about the breadth of its own aeronautics activities, existing implementation plans, degree of follow-through, and connection to the enterprise's ultimate customers. The ensuing recommendations had ranged from the very general—e.g., continuation of Government support for air transportation—to the very specific—e.g., rotorcraft research. In terms of program breadth, the NRC panel had concluded that Code R was attempting to do too much and should reduce discrete tasks in its portfolio. In addition, managers should pursue more high-risk, high-payoff technologies, as well as more long-term research. Mr. Hertz noted that he wanted to conduct such research within each of Code R's three major program areas rather than through a general research office. Looking at Code R's field center infrastructure, the panel had found more facilities than could be effectively utilized; however, it warned against closing strategic facilities strictly on the basis of full-cost accounting. Overall, NRC reviewers had offered more than 200 recommendations and findings, and Mr. Hertz intended for his office to address each one.

Dr. Brackey concluded that the key recommendation to assert world leadership in aeronautics represented the core of the panel's findings and that everything else sought to enable it. This observation echoed a recurring theme in the day's discussions: Who should be the architect, integrator, and keeper of the Nation's aeronautics vision? Dr. Crow suggested that no one agency occupied that role today and that ATAC should set aside time to address the issue. Dr. Lebacqz agreed. Mr. Anderson noted that an NRC briefing before ATAC's Revolutionize Aviation Subcommittee (RAS) seemed to fault NASA for not exhibiting leadership in certain areas even though OMB had signaled its disapproval of such strategies. Several ATAC members pointed to Richard Wlezien's leadership in Vehicle Systems—particularly his approach to outreach and consensus building—as a model for the rest of Code R. Mr. Hertz agreed with this assessment of Dr. Wlezien's accomplishments. He also reaffirmed his own position that leadership in aeronautical technology was indeed a proper role of the agency. Such a view, however, stopped short of claiming dominion over all of aviation, a much broader realm of stakeholders that extended far beyond technology to the world of policy makers and enforcers. Dr. Rediess, however, maintained that part of technology leadership involved policy evaluation. Adm. Wieringer cautioned against using the term "leadership" casually when moving from one domain to another. From another perspective, Dr. Weber suggested that the agency was letting itself be circumscribed by the qualifier "as only NASA can" and was holding back in areas where it perceived other entities exhibited expertise. In Mr. Cappuccio's view, some kind of acknowledged leadership role in aeronautics for NASA could help neutralize the temptation for Congress and OMB to cut Code R's totally visible (and therefore vulnerable) budgets in coming years. Mr.

Anderson said that he did not see any other player in aeronautics than NASA that could broker the dialog and maintain the roadmaps.

Dr. Gellman proposed that NASA exhibit leadership by publicizing the Nation's needs in aeronautics and offering prizes as the Guggenheimer family did early in the 20th century. Dr. Lebacqz replied that some Centennial Awards already being planned within the agency might serve this purpose.

Mr. Hertz concluded his presentation by quickly summarizing Code R responses to selected ATAC panel recommendations. Among the activities cited were participation in an Interagency Homeland Air Security Steering Committee meeting; collaboration with Code I to develop a memorandum of understanding with TSA on explosives detection; representation of TSA on ATAC and RAS; a joint ATAC and REDAC meeting planned for September; and active support of the JPDO by three RAS subcommittees.

RAS Report

Dr. Crow, chair of the RAS, focused on the subcommittee's support for Code R's proposed budget augmentations. He said that the enterprise had been using its resources very effectively, as evidenced by the great strides that it had made in the last 2 years. The augmentations appeared justified in that context. He briefly went down the list, highlighting the highest priorities—NAS transformation and HALE UAVs. A supersonic overland cruiser, hypersonics, and next generation power sources such as solid oxide fuel cells were also mentioned. He encouraged the ATAC to support this group of plus-ups so that the agency could exercise leadership in aeronautics during the next century.

In the discussion that followed, Mr. Swain suggested that the list needed to be sequenced for priority. Dr. Lebacqz noted that the Administrator himself had singled out NAS transformation as one of two top agency-wide priorities for augmentation. His other selection—for Earth Science—also tied into aeronautics because it involved UAVs. Overall, however, Dr. Lebacqz held out little hope for success on any of the augmentation proposals because NASA was one of the very few Federal agencies to receive an overall budget increase this year.

Mr. Swanda asked why software certification did not appear among the favored projects, given the great importance that avionics manufacturers attached to it. NASA's current work in this field seemed to him to be understaffed and underfunded. Mr. Hertz replied that certification was not on the augmentation list because it was part of an ongoing enterprise program. Dr. Lebacqz also mentioned other places within NASA, such as CICT, where such work was taking place, although he no longer controlled that program. Mr. Swanda said that he was beginning to conclude that the agency did not have the capability to address the challenge.

Dr. Gellman noted that none of the augmentation proposals directly addressed the globalized economy and Europe's 2020 plan. JPDO did not seem to be dealing with these issues either. Dr. Lebacqz replied that arguments for engagement in that direction were not likely to gain support from the Administrator.

Dr. Crow suggested that ATAC should actively address the gap between the percentage of NASA's aeronautics employees (approximately 40 percent of the agency workforce) and the fraction of the agency budget received by Code R (1/15). It also appeared to him that several centers probably would face closure in the wake of full cost accounting. Dr. Lebacqz replied that Code R's centers had sources of support other than the Aeronautics budget—e.g., other enterprises within NASA. He also mentioned that a team of associate administrators and center directors was evaluating whether the institutional program office role should continue or whether it would be better for all the centers to be organized under one overarching structure.

Office of Exploration Systems

The Associate Administrator for Exploration Systems, Craig Steidle, provided an overview of Code T, now in its 11th week of existence. He reported that the new enterprise had begun in January just after the President had articulated a new vision for space exploration in the 21st century. The undertaking encompassed a broad range of robotic and human missions to the moon, Mars, and beyond. Industry and international partners would contribute to the overall mission. Already a host of programs throughout the agency had migrated to Code T; some would readily fit, others would refocus, and a number would terminate. There would also be some new starts. The biggest challenge would be to sustain this effort over the long term.

The presentation outlined 18 milestones that supported the vision, such as refocused ISS research, separation of ISS crew and cargo, development of the CEV, and several others described earlier by Dr. Lebacqz. Major milestones included an initial flight test of the CEV and launch of a lunar robotic orbiter (FY08), robotic lunar landing (FY09), first uncrewed (FY11) and crewed (FY14) CEV flight, launch of the Jupiter Icy Moon Orbiter (JIMO)/ Prometheus project (FY12-15), and return of humans to the moon (FY15-20). This stepping stone approach would provide a range of returns on investment, as well as inspire a new generation of space explorers.

Adm. Steidle described some of his own background and approach to developing new technologies, including the Joint Strike Fighter. He discussed life cycle and performance issues, technology maturation and insertion, partnerships with industry, and the importance of requirements definition and control (as highlighted in the Tom Young report). A good deal of effort would be expended on modeling specific missions. Gap analysis would identify deficiencies that could be matched up against the some 140 technology maturation programs that had migrated to his enterprise. By the end of the summer, he should be able to trace investments all the way back to the President's vision. The remainder of Adm. Steidle's presentation touched on a variety of management and operational themes, including internal enterprise structure (Requirements, Business Operations, and Development Programs), Constellation architectural components, and reliance on spiral development strategies (unknown end state requirement). He also described a program of Centennial Challenges that would establish prize purses to foster innovation and competition in fields of interest to the agency, such as fundamental technologies, breakthrough robotics, and low-cost space missions. The program would be

funded at $20 million annually starting in FY05. Summing up, Adm. Steidle emphasized that the new exploration initiative would prove to be affordable and sustainable.

During the discussion that followed, Adm. Steidle fielded a variety of questions. He noted that he planned to establish an advisory body similar to the ATAC perhaps by summer; in the meantime he would continue to report directly to the NAC. As for programs that had migrated from Code R to Code T, he predicted that many would be rescoped, although a decision had been made not to go forward with hypersonics. Overall, he believed that he had enough funding to support his objectives through FY09-10. His two top challenges were program sustainability and vertical integration. He said that technology development at the individual program level did not pose the greatest obstacles. Rather, it was the systems, psychological, and management components that demanded the most attention.

Turning briefly to the Prometheus project, he briefly described why a spacecraft traveling beyond the useful range of solar power in the outer solar system required an alternative energy source. The Department of Energy had recently given permission to the Prometheus project to design and build a reactor for a nuclear-electric propulsion system. The ion engines being developed held promise for many other applications, as did various other elements of the exploration initiative, including the CEV.

Advanced Space Transportation Subcommittee Report

Standing in for Subcommittee Chair Mercer, Mr. Cappuccio reported that the overall finding at the October 2003 meeting had been that the budgets for OSP and NGLT were inadequate to support these programs adequately. The subcommittee had discussed pulling OSP out of the system and asking for funding to spin it out separately. The pace of development had appeared out of sync with the purpose of rescuing endangered crew members. Subcommittee members had expressed differing ideas about the optimal deployment timeframe. Since the meeting, these concerns had been overtaken by the President's new exploration initiative.

Mr. Cappuccio commended the Advance Range and Spaceport Technology Working Groups for their contributions to the subcommittee, and he asked ATAC to accept their reports, as well as the subcommittee's recommendations. He also asked the committee to keep the subcommittee in place until Adm. Steidle formed his own advisory groups later in the year.

Commenting on the subcommittee's overall finding, Dr. Lebacqz said that the record should indicate that the OSP program stayed on schedule and within budget and did everything that it was asked to do.

At this point Mr. Swain recessed the public ATAC meeting until the next morning. He said that committee members would continue to meet in a Non-FACA Fact Finding Session with Dr. Lebacqz, Mr. Hertz, and Mr. Green.

Morning Session, March 25

Strategic Aerospace Capabilities Team (SACT)

Dr. Lebacqz introduced Richard Antcliff as the team leader of a 1-month cross-center study looking at alternative ways of managing the enterprise's field centers. Dr. Lebacqz emphasized that this study was just one among several investigations being conducted by Code R on this subject and that he welcomed ATAC feedback on the day's presentation.

In outlining the background to the study, Mr. Antcliff described how centers often found themselves fighting against a death spiral as rates to customers increased, the customer base eroded, costs escalated further, and additional clients disengaged. Facilities were particularly vulnerable during low-activity periods of their business cycles. When problems persisted, the skills of facility operators and ability to conduct research declined, while safety issues started to loom. To address these issues, a diverse mix of project managers, facility operators, computational facility staff, and budget and acquisitions staff visited facilities at the beginning of the year, solicited input, and developed a collective review. The team considered not only wind tunnels but the full spectrum of flight assets and support equipment. Their purpose was not to determine which centers should remain open, but rather to devise a long-term system that could address such crucial questions intelligently as changes occurred. Dr. Lebacqz was particularly interested in determining whether the field centers maintained the right suite of capabilities to do scientific research at some future date.

A report was issued in early March of 2004. Overall, the team found that centers were not optimizing facilities and were choosing to accept risk instead of paying for testing. At present the centers were operating in a run-to-failure mode, and problems were likely to grow as the full impact of full cost accounting and the shift to Code T set in. There was a tendency for centers to close facilities before the strategic significance of the loss had been assessed.

In developing alternative management strategies, SACT members consulted a range of benchmark studies, such as recent assessments by the RAND Corporation, the NRC, and Commission on the Future of the Aerospace Industry. Current practice within Code R was to create a $15 million reserve fund for emergencies during each fiscal year. One alternative to this arrangement was a shared stewardship model, but that option was precluded by the spinoff of Code T, which reduced available service pool funding beyond the threshold of usefulness. Other options included a multi-enterprise governing board and an optimized service pool system in which all facilities were placed in one service pool and staff were cross-trained. The latter model had in fact worked well at the Glenn Center, which was not experiencing the problems associated with the death spiral. The last alternative considered by the team was a disruptive capability model that encouraged investment in new facilities. This approach reduced the cost of testing by using technology intelligently and by modifying the suite of facilities to accommodate the needs of cutting edge projects.

When the team scored the elements of these models and depicted them in a matrix, it became apparent that no one system excelled at everything. Consequently, SACT

members developed a hybrid management model that incorporated the best features of each. From the multi-enterprise governing board model, the team derived a mechanism for damping cycle fluctuations; from the service pool approach emerged a rate stabilization strategy; and from the disruptive capability program issued a viable vehicle for providing appropriate facilities for the 21st century. Mr. Antcliff talked briefly about the multi-enterprise board that would ultimately decide which facilities would be retained and which decommissioned. Representatives for the board would come from five codes, including R and T, as well as from Code R centers. Leadership within the board would rotate. This long-term body would provide strategic oversight, develop metrics, and establish a yearly capability portfolio. Beyond this, Mr. Antcliff displayed a long list of stakeholders encompassing other NASA Enterprises, Congress, OMB, local and State governments, contractors, users, and universities. Every year NASA could facilitate a workshop among these parties. He noted that about 40 percent of those using Code R facilities came from outside the enterprise; only about 10 percent, however, came from outside NASA

Overall, Mr. Antcliff suggested that the current hybrid model complied with the intended consequences of full cost accounting and avoided the appearance of center resistance to downsizing. He said that OMB could readily discern the plan for strategic center management and that Codes A, B, and J could easily evaluate cost compliance. The team recommended that Code R now set up a governing board and chose an optimal strategy for the disruptive capability program. He estimated that the entire facilities cost ranged between $250 million and $500 million.

During the discussion, Mr. Swain commented that the Glenn experiment had fared reasonably well in the areas of cross-training and workforce reduction. He also welcomed the overall idea of procedural coordination at the enterprise level so that all the terms, rules, and conditions set independently within the centers today would be made uniform. Dr. Crow, too, emphasized the need for NASA to standardize its operations, particularly among its many data and accounting systems. He argued that without consistent data, the governing board would be at the mercy of anyone coming before it. In his view, the presentation itself would have benefited from more data on the enterprise's resources and obligations.

Dr. Gellman questioned the service pool concept. This invited cross-subsidies, which he thought would be a mistake. He noted that cross-training could take place without the creation of service pools. Also, Dr. Gellman cautioned again the danger of reciprocal favoritism within the governing board.

In the area of leadership, Mr. Anderson expressed uneasiness about the capability model because it did not seem to articulate a clear vision of key strategic partners. NASA, he said, could not define the future on its own. Mr. Spitzer also suggested that the agency reconsider any sentiments within its ranks to concentrate only on those technologies of benefit to itself. On the other hand, he suggested that the agency recognize the importance of its leadership potential and the possibility of displacement by some other authority in Government if such leadership was not asserted.

Dr. Brackey expressed his appreciation for the work of the SACT team but noted some disappointment that the underlying question for him remained—i.e., how Code R justified the money spent on its facilities. He thought this matter should be pursued more vigorously. Secondly, he suggested taking a more national approach laying out the respective roles of NASA, the Air Force, and the Navy.

Although Mr. Cappuccio did not think the hybrid model represented perfection, he said that it was good enough for Code R to move out in parallel with what it had. He suggested staff could start estimating milestones and establishing a schedule.

Mr. Swain concluded the discussion by summarizing certain major points: take action in the short term; determine what was needed to standardize procedures to ensure the capture of useful data; share human resources; and shift the issue from closing centers to reducing costs. He pointed out that the savings achieved from standardization alone might make the closing of some facilities unnecessary.

University Strategy

Michael Reischman began the last presentation with a restatement of the principles defining Code R's work in the university community. These included partnerships, balance/synergy of efforts, sustained mission-related relationships, and competitive engagement. The underlying thrust of his mission was to restore a sense of trust between the agency and academic researchers who had become disenchanted with NASA in previous years because of budget and oversight discontinuities. He also hoped that Code R's current efforts would foster workforce development, systematic communication, and university advocacy for the agency.

Before the spinoff of Code T, the total funding for University Programs was $158 million (9.8 percent of the Code R budget), including earmarks. After the outmigration of space-related programs, total funding had dropped to $76 million, but the budget percentage had increased (12.7 percent).

Mr. Reischman described three experiments under way in interactions with universities. All of these addressed a previously underrepresented area—i.e., large-scale multidisciplinary research efforts. The first group discussed was the University Research, Engineering and Technology Institutes (URETIs), a combined research and education arrangement presently encompassing seven entities. Three of these focused on power and propulsion, while the remainder investigated bio-, nano-, and information technologies, as well as fusions of these. The 5-year cooperative agreements were renewable up to 10 years at a cost of $19 million per year for Code R. Additional funding for power and propulsion received from the Department of Defense.

Mr. Reischman reported that 32 colleges and universities were involved in this program, including almost 25 percent from minority institutions. Participating faculty numbered 232, while graduate and undergraduate students accounted for 301 and 92 individuals, respectively. Such participation had won support from OMB because examiners there

were eager for NASA to secure the best talent available and to encourage competition with the agency's workforce in the centers. Dr. Lebacqz indicated his interest in pursuing this competitive strategy in Code R, particularly in low-technology-readiness-level work.

The subject of building external trust amid agency reorganization arose. Some URETIs had already migrated to Code T, which was evaluating them. Mr. Reischman expressed hopes that these would be continued over the entire 5-year period. Dr. Katehi voiced concern when she learned that no one individual would be overseeing these programs on a daily basis. She recalled the disruptions caused in previous decades on her campus when reviewers and standards remained in flux. Dr. Lebacqz stated his firm intention to correct past abuses and to ensure an atmosphere of predictability in relations with university partners.

The second experiment outlined by Mr. Reischman was the University-Affiliated Research Center (UARC), a facility at Ames that was affiliated through competitive award with the entire University of California System. This academic network comprised some 600 research institutes and programs in the State system. Minority institutions would also be connected as subcontractors. The overall program began with $15 million and would grow to $120 million over 5 years; it was renewable to10 years at a maximum value of $322 million. The initial $15 million had a flexible focus and related largely to ongoing tasks at Ames. From one perspective, the arrangement appeared to be a change in prime contractor. Employees under the old contract could switch to the university payroll or be replaced by someone from the academic community there.

The third experiment was the National Institute for Aerospace, which formed in FY02 by cooperative agreement and contract among nine universities. The arrangement offered some of the flexibility of a grant but still allowed for the option to assign specific tasks. The budget provided $5 million per year for 5 years, with three 5-year options. Mr. Reischman was able to leverage 2.6 million for the first 2 years.

All three of these experiments were up and running, Mr. Reischman reported, although the level of success achieved still needed to be determined. He noted that Code R was moving to an external peer review process in its University Program activities.

Mr. Reischman turned to two important developments within the Enterprise's university strategy. The first was Dr. Lebacqz's decision to incorporate an IPA position holder from a university to serve as the new Director of University Programs. Also, Code R would be establishing a Council of Deans as another advisory group. This Council would advise the Associate Administrator on policy, research, and education trends; evaluate processes and procedures; and explore routes for expanding relationships. It could function as a subcommittee of ATAC (or its successor) and include about 15 members with 2- to 4-year terms. A wide spectrum of colleges would be represented. Meetings would probably be semiannual. He showed a list of candidate institutions to be affiliated with the Council.

The final portion of Mr. Reischman's presentation offered responses to actions proposed during the last ATAC meeting. He addressed budget targets (an enterprise-wide funding

goal bracketed at 12-15 percent), guidelines for center participation (minimum of 3 years for small-scale projects and 5 years for long-term ones), R&D mix (balance of large- and small-scale projects), and innovative programs for students and faculty (research funding and recruiting initiatives).

Findings and Recommendations

After Mr. Reischman ended his presentation, Mr. Swain offered for the record his sense of the committee's resolve regarding the day's discussions. These conclusions, as well as those articulated during the fact-finding session, appear below. After his brief summation, Mr. Swain adjourned the meeting.

NASA's aeronautics programs are well planned, prioritized, and integrated, but underfunding is preventing them from meeting society's needs in a timely fashion and may make them obsolete.

This committee thinks that it is important for NASA to take a leadership role in aeronautics technology. Such leadership was effectively demonstrated in the redesign of the Vehicle Systems Program, which brought industry, government, and academia together to develop a strategy for making long-term investments; ATAC endorses this example and the plan for the new Aeronautics Enterprise.

ATAC is concerned that current funding may not be consistent with maintaining world leadership in aeronautics. The committee therefore endorses the following list of proposed budget augmentations for Code R:

Transforming the NAS
HALE ROA technologies and operations
Next generation clean aircraft power
Aviation security for ATS
Quite, safe rotorcraft
Aviation accident reconstruction
Research and technology test and evaluation environment
Overland supersonic cruise demonstrator
Hypersonics

In this period of constrained funding, it is important to apply the peer/external review process and program prioritization to every dollar that NASA spends in this area.

Code R needs to take action in the area of facilities management. The enterprise should seriously consider how to structure its procedures and policies in a way that improves productivity and lowers costs through standardization and other measures.

ATAC fully supports the long-term agreements that NASA has made with universities and recommends that great care be taken not to disrupt these.

Specifically, the committee requests that a single individual be designated within the enterprise to ensure the day-to-day well being of university partners.

Action Items

What are the gaps between the new Aeronautics plan and maintaining world leadership (for committee and staff to address at next meeting)?

How does Code R contribute to the space initiative? Dr. Lebacqz and Mr. Green can provide guidance on this (needs to be addressed so that ATAC can report back to the NAC).

All suggestions about reforming the committee membership should be submitted directly to Dr. Lebacqz.